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L3: Entry 2 of 2 File: USPT Jul 23, 2002

US-PAT-NO: 6423229
DOCUMENT-IDENTIFIER: US 6423229 B1

TITLE: Bioreactor systems for biological nutrient removal

DATE-ISSUED: July 23, 2002

INVENTOR-INFORMATION:

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US-CL-ISSUED: 210/603; 210/605, 210/606
US-CL-CURRENT: 210/603; 210/605, 210/606

FIELD-OF-SEARCH: 210/610, 210/605, 210/603, 210/630, 210/620-622, 210/606

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected | Search ALL

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	5071747	December 1991	Hough et al.	
☐	5240598	August 1993	Portier et al.	
☐	5342522	August 1994	Marsman et al.	
☐	5393427	February 1995	Bernard	
☐	5534143	July 1996	Portier et al.	
☐	5582732	December 1996	Mao et al.	
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☐	5919367	July 1999	Khudenko	
☐	6015496	January 2000	Khudenko	

FOREIGN PATENT DOCUMENTS

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TITLE: Bioreactor systems for biological nutrient removal

US Patent No. (1):
6423229

Brief Summary Text (28):
In another embodiment, the process further comprises a step of passing at least a portion of the effluent from the anaerobic bioreactor through a strictly anaerobic bioreactor comprising an immobilized methanogenic microbial consortia which metabolize the VFA's and produce methane.

Brief Summary Text (36):
In one embodiment, the bioreactor further comprises an gas dissolving system for introducing oxygen into the BOD/nitrogen removal chamber such that an upper portion of said chamber is aerobic. The gas dissolving system may also introduce ozone into the BOD/nitrogen removal chamber.

Detailed Description Text (17):
In the Stage I anaerobic bioreactor (12a), immobilized facultative microbial consortia hydrolyze the complex or suspended organics and ferment them into volatile fatty acids (VFAs). As well, complex N compounds are broken down primarily into ammonia and complex P-compounds are broken down into orthophosphate. The VFA's may then be used by other microbial consortia in downstream bioreactors for P-removal and denitrification. As a result, it may be unnecessary to add a carbon source to the system. Usually in a conventional system, it is necessary to add excess methanol or other carbon sources in order to obtain efficient denitrification and P-removal.

Detailed Description Text (48):
Firstly, a Stage II anaerobic bioreactor (12b) may be provided to recover energy in the form of methane gas. In this strictly anaerobic bioreactor (12b), methanogenic microbial consortia then convert the previous VFA's from the Stage I bioreactor(12a) to methane. The Stage II bioreactor (12b) has little impact on NH.sub.3 and PO.sub.4 in the wastewater. The effluent from the Stage II bioreactor (12b) may be passed directly to a BOD bioreactor (20) as described below.

Detailed Description Text (56):
The anaerobic treated wastewater is introduced into the anoxic zone of aerobic chamber (106) along a channel between the dividing wall (108) and biomedia. Organic compounds are first used for removal of NO.sub.3.in the anoxic zone (106a) if desired. After denitrification, the residual organics in the liquid then comes into contact with the biomass immobilized at the top portion (106c) of the biomedia. This portion of biomedia is exposed to the air during the siphon cycles, thus oxygen is readily available to the microorganisms immobilized in the biomedia. In addition, in one embodiment, a venturi and gas dissolving system (108) may add D.O. and/or ozone into the liquid that is pumped to the top. By adjusting the organic loading, recycling rate and level of DO in the liquid, the second chamber from top to bottom can be divided into BOD (106c), nitrification (106b) and denitrification (106a) zones. The height of each zone depends on the organic loading, concentration of N as well as the rate of recycling and DO addition. The system only requires a pump and two level controllers for continuous operation. In one embodiment, the operation of the pump (110) and oxygenation system (108) is so designed that it can dissolve ozone and oxygen at same time while it brings the liquid to the top of bioreactor (106) for uniform distribution or to the discharge outlet (112).

Detailed Description Text (57):
In one embodiment, the effluent from the aerobic chamber (106) may be further polished at the upper section of TE chamber (114) and, if desired, disinfected through contacting with ozone from the gas dissolving system (108), then directly discharged in a process that is controlled by the water level in the TE chamber (108).

CLAIMS:

3. The process of claim 2 further comprising the step of passing at least a portion of the effluent from the anaerobic bioreactor through a strictly anaerobic bioreactor comprising an immobilized methanogenic microbial consortia which metabolize the VFA's and produce methane.

19. The process of claim 16 wherein the methane produced in the strictly anaerobic bioreactor is removed and collected.

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
2000254675	September 2000	JP	

OTHER PUBLICATIONS

US Trademark Electronic Search System (TESS) copy of US Trademark Registration No. 0390506 for TWEEN covering emulsifying, wetting and dispersing agents.

ART-UNIT: 1724

PRIMARY-EXAMINER: Barry; Chester T.

ABSTRACT:

An integrated biological treatment process and bioreactor system provides means for simultaneous removal of biodegradable solids (TSS), nitrogen (N) and phosphate (P) from water and wastewater. The system comprises microbial consortia immobilized in separate bioreactors for anaerobic processes, P removal, dentrification and, optionally, BOD removal and polishing.

19 Claims, 16 Drawing figures

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Search Results - Record(s) 1 through 14 of 14 returned.

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9. 5560737. 15 Aug 95; 01 Oct 96. Pneumatic fracturing and multicomponent injection enhancement of in situ bioremediation. Schuring; John R., et al. 405/128.45; 166/246 166/308 166/53 210/747 405/128.5 405/263 435/262. B09C001/08 E21B043/12 E21B043/26.

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l11 not l9 not l7	14

Previous Page Next Page